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ABSTRACT

In a discussion of the role of language in education, education is viewed as a semiotic apprenticeship, or opportunity to gain the cultural tools and practices for meaning-making in construction of knowledge. This process occurs through guided participation in discipline-based forms of inquiry. In this enterprise, language is seen as having a special function, providing tools both to mediate participation in an activity and to reflect on that activity. The ways in which written and oral discourse contribute to inquiry in the classroom and in class activities are examined. It is proposed further that this learner-centered view of the classroom as a community of inquiry suggests re-examination of the role of the teacher, and adoption of the teacher's role as active participant in inquiry. (MSE)

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TEXT, TALK AND INQUIRY: SCHOOLING AS SEMIOTIC APPRENTICESHIP

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The claim that language has a central role in all aspects of education, and particularly in learning and teaching, would not be treated as news by those whose job is to teach a first, second or foreign language. Furthermore, we should probably hope that the central role of language would be equally self-evident to teachers in all areas of the curriculum. However, if we were to try to specify in more detail what that role is or should be, we might rather quickly discover that there were some fundamental differences of opinion, corresponding at least in part to the 'subjects' taught, but also to what might be called teachers' underlying philosophies. Rather than spell out possible alternatives, however, I should like to present one particular conception of education in order to use it as a framework for considering the relationships between written texts, talk and action, as these apply in all areas of the curriculum.

Learning through Participation in Culturally Significant Activities

Many years ago, in Education and Experience, Dewey (1938) made a simple observation, but one whose implications for classroom practice have still to be taken seriously: Human beings learn by doing. And at about the same time, but in a very different part of the world, a similar insight about learning through joint activity was being developed into a comprehensive theory of learning-and-teaching by Vygotsky and his colleagues and students (Vygotsky, 1978, 1987; Leontiev, 1981; Luria, 1978). Having remained unknown outside the Soviet Union until their work began to be translated into English and other languages in the last couple of decades, the key ideas developed by this 'troika' are now beginning to have a very considerable impact on education at all levels from pre-school to teacher education.

Simply put, Vygotsky argued that each human being's capacities for acting, thinking, feeling and communicating, although based in his or her biological inheritance, are crucially dependent on the appropriation of the practices and artifacts developed over time within particular cultures in the course of goal-oriented joint activity. As Budilova puts it:

> ...a special form of transmitting the achievements of preceding generations to the next takes place in human society; that is the achievements are embodied in the material and symbolic products of human activities, and specific human psychological abilities can be developed through the mastery of these products by each person.
>
> (1972, p.310; translated and quoted by Amano, 1991)

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Four features of this account merit further attention. First, the notion of 'product', or 'artifact'. The importance of material artifacts for the development of culture is by now well understood; the invention of the flint knife and, later, of the wheel are recognized to have radically changed the possibilities for action of the prehistoric societies which invented them and of those that took over their inventions. In more recent times, the same sort of significance is attributed to the invention of the printing press, powered flying machines and the microchip. But Vygotsky's great contribution was to recognize that an even greater effect resulted from the development of semiotic tools based on signs, of which the most powerful and versatile is speech. For not only does speech function as a tool that mediates social action, it also provides one of the chief means - in what Vygotsky (1987) called 'inner speech' - of mediating the individual mental activities of remembering, thinking and reasoning.

The second feature of importance is the strong emphasis on activity as the site of both invention and use of all forms of artifact. Whether material or symbolic, artifacts are embedded in practices which have as their object the satisfaction of perceived needs. In this sense, an artifact has no meaning out of the context of activity, and to master the use of an artifact is to learn to participate in the practices in which it plays a functional mediating role. Here is Leontiev's elaboration on this point:

> The tool mediates activity and thus connects humans not only with the world of objects but also with other people. Because of this, humans' activity assimilates the experiences of humankind. This means that humans' mental processes ... acquire a structure necessarily tied to the sociohistorically formed means and methods transmitted to them by others in the process of cooperative labor and social interaction ... In other words, higher psychological processes unique to humans can be acquired only through interaction with others, that is, through interpsychological processes that only later will begin to be carried out independently by the individual.
>
> (Leontiev, 1981, pp.55-6. Emphasis in original.)

In the last sentence of this quotation Leontiev focuses on the third and perhaps the most important feature of the sociocultural theory of intellectual development, namely that of appropriation. Simply put, all higher mental functions are dependent on semiotic artifacts and practices that are first encountered intermentally in purposeful joint activities, in which more expert members of the culture both demonstrate their use and assist the learner in mastering them. Through participation in which his or her performance is assisted, the learner gradually masters the practices in which these artifacts are used so that they also become a resource for intramental activity. As Vygotsky puts it, on its way to becoming an internal mode of activity, "any higher mental function necessarily goes through an external stage in its development because it is initially a social function" (1981, p.162).

However, appropriation is not the end of the process, for the final stage occurs in further action, when the learner makes use of the new function to participate more effectively in similar or related social activity. Appropriation of cultural artifacts and practices thus involves a contining three-stage cycle, to which corresponds a triple transformation. First there is the transformation of the learner - a modification of his or her own mental processes, that changes the ways in which he or she perceives, interprets and represents the world; second there is a transformation of the artifact itself, as its use is assimilated and

reconstructed by the learner on the basis of the learner's existing knowledge; finally, in using the artifact to mediate further action, there is a transformation of the situation in which the learner acts which, to a greater or lesser degree, brings about change in the social practice and in the way in which the artifact is understood and used by other members of the culture.[2]

Finally, because appropriation of cultural resources takes place through the learner's participation in goal-oriented joint activities, a further key feature of learning concerns the part played by the other, more expert participants in facilitating this process. Their role is to help the learner to understand the significance of the activity as a whole and of the constituent actions and artifacts that mediate iits performance and, while taking responsibility for the organization of the overall structure, to involve him or her as fully as possible, providing help and guidance with those parts of the activity that he or she cannot yet manage on his or her own. However, this assistance is seen as only a temporary 'scaffolding' (Wood, Bruner and Ross, 1976), the purpose of which is to enable the learner to become a fully competent, independently-functioning participant. Vygotsky (1978, 1987) described this 'teaching' role as working with the learner in his or her "zone of proximal development":

> an essential feature of learning is that it creates the zone of proximal development; that is learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. (1978, p.90)

To summarize this view of education, as it applies to schooling, therefore, we might characterize it as the creation of a collaborative community of practice, in which, through assisted participation in appropriate activities, students undertake a 'semiotic apprenticeship', as they individually reconstruct the resources of the culture as tools for creative and responsible social living in this and the wider community. In this characterization, it is activity which is central, for, to rephrase Dewey's insight, what we learn is what we do.

Learning in School: A Semiotic Apprenticeship

In choosing the metaphor of 'semiotic apprenticeship' to characterize learning in school, I wish to emphasize three important points. The first is that learning should be seen as the gradual but cumulative development of expertise through participation in the activities in which, in the various disciplines, knowledge is progresively constructed, applied and revised; and the second is that, in their learning, students should be assisted and guided by others who engage with them in these activities and share their expertise. Both these points have been developed in some detail by Vygotsky and by contemporary sociocultural theorists (Chang-Wells and Wells, 1993; Cole, 1985; Lave and Wenger, 1991; Rogoff, 1990; Tharp and Gallimore, 1988; Wertsch, 1985), so I shall not develop them further. However, my third point - the semiotic nature of learning - has received rather less attention, and so it is on this that I shall focus here.

In the preceding section, I frequently used the rather general expression 'the resources of the

culture' to refer to what has to be learned in the course of the semiotic apprenticeship. Without attempting to specify in detail what these resources are, I should like to suggest that they can be thought of as consisting of three broad categories: a) attitudes and values concerning what are worthwhile activities to engage in; b) understanding of the practices involved in these activities; and c) mastery of the relevant artifacts and of the procedural and substantive knowledge associated with their use. In sociocultural theory, all these resources are viewed as mediational means for the achievement of collective and individual goals. In that sense, they can be thought of as 'tools'. But, whether material or symbolic, in order to perform their mediating function, all tools must meet two requirements: first, they must be capable of contributing to the achievement of desired effects in the world; and second, they must be in the hands of a person who understands their meaning and mode of functioning in relation to the goals of the activity they mediate (Cole, in press).

From the learner's point of view, the first requirement is not initially in question: the efficacy of a tool is taken for granted on the basis of its continued use in the home and wider community. In the first instance, therefore, the learner's major task is to discover - in action - when, where and how to use the culture's most important tools, that is to say, to learn their semiotic significance. In this process, language provides the most important resource of all, for it is, as Cole (in press) puts it, "the master tool" - the tool that mediates the learning of all others.

In order to attempt to explicate this central role of language in learning, I should like to draw on some of the ideas contained in recent papers by Halliday (in press, this volume), in which he summarizes and extends his previous work on language learning. In the introduction to this paper, Halliday states: "the distinctive characteristic of human learning is that it is a process of making meaning - a semiotic process; and the prototypical form of human semiotic is language" (in press, p.1). Then, in the body of the paper, he goes on to show in detail how, in learning the language of his or her community, that is to say in constructing its grammar as a 'meaning potential', the child appropriates a powerful and versatile tool for participating in and reflecting on activity, in collaboration with others. Like Dewey and Vygotsky, too, Halliday emphasizes that what children learn with respect to language depends on what they use it to do.

When we come to consider language from this latter point of view, it is clear that there are two rather different kinds of doing in which language plays a part, which we might gloss, rather generally, as 'acting' and 'understanding', corresponding to an emphasis on the interpersonal or the ideational metafunctions in terms of which - together with the textual metafunction - the grammar is organized (Halliday, 1978, in press). In the first of these, the primary function of language is to mediate action: to negotiate goals and means, to monitor other, non-verbal, forms of behaviour, and to manage the interpersonal relationships involved. In the second, where the emphasis is on reflection, the function of language which is emphasized is that of 'representing' objects, events and relationships - of creating "a theory of human experience" - "a semiotic world of its own: a parallel universe ... [which serves] as model, or metaphor, for the world of action and experience" (Halliday, in press, p.15-16).

Of course, these two forms of doing are never totally distinct and separate. In the former, language provides an important means of making reference to the other components of the activity in which the participants are engaged; and in the latter, any sustained reflection also

requires the management of goals and interpersonal relationships. This is true of discourse contributions of any size: Whether the utterance is a single clause or a full-length book, choices are made with respect to both ideational and interpersonal metafunctions; in all utterances, too, choices with respect to the textual metafunction are necessary in order to make the utterance effective in its context. Nevertheless, as Britton's (1970) rather similar distinction between the 'participant' and 'spectator' modes suggests, there is an important difference between the two types of doing with language - acting and reflecting - and, for each, the grammar as a whole provides rather different kinds of semiotic resources.

This distinction will become clearer, I hope, as we turn to the various functions that language performs in the different activities that we might expect students to engage in in the classroom, if these activities are seen as an apprenticeship into the various 'ways of knowing' (including knowing in action)on which the curriculum is based. For, in all the disciplines there are some activities that are more oriented to action and others that more obviously involve reflection, and each involves different choices from the semantic meaning potential.[3]

In the sciences, for example, a rather clear, although oversimple, distinction can be drawn between empirical and theoretical activities and, in each, language plays a rather different role. For example, we should expect to find that the kinds of discourse that occur in the context of planning and carrying out experiments are rather different from those that occur when predictions are considered in advance of the experiment or the significance of the results is subsequently interpreted in relation to the prevailing theory. In history, a comparable distinction can be made between the kinds of discourse involved in the obtaining and handling of the documents and other artifacts that constitute historical evidence, and those in which the significance of this evidence is evaluated and debated. Similarly, in the study of literature, there is clearly a difference between, on the one hand, reading a novel or poem and responding, as one reads, in terms of the particular thoughts and feelings evoked, and attempting, on the other hand, to explain the work's overall effect by reference to specific features of the text seen as instances of more general literary categories. In each of these cases, although the same substantive 'content' may be involved in the two situations, the activities in which this content is worked on are different, and so are the discourse genres through which these activities are enacted. In the first of the contrasted situations in each case, the discourse plays a somewhat ancillary role in relation to the activity as a whole, whereas in the second the discourse actually constitutes the activity.

The important point, however, is that, within each of these academic disciplines, both forms of semiotic activity are recognized to be important, as is mastery of the genres of discourse involved. Indeed, in achieving the overall goals of the discipline, the different discourse genres perform complementary and interdependent functions, together constituting, in large part, what it is to 'do' science, history or literature.

The same, I want to suggest, should be true in the classroom. In order for their learning to constitute a genuine apprenticeship into the different disciplines, students should have the opportunity to encounter and master the important genres of discourse in each discipline through engaging in as wide a range as possible of the activities in which those genres are used. They should also receive assistance in their learning in the form of appropriate models and constructive feedback and guidance.

Before going on to consider how such a goal might be achieved, however, I want to look more closely at the semiotic resources provided by language, starting with a consideration of some of the differences between talk and text.

The Distinguishing Features of Written Text

There are a number of ways in which spoken and written discourse can be contrasted, all of which are relevant to a consideration of the role of language in learning and teaching. However, because of limitations of space, I shall consider only three.

1. The abstract nature of written text

In the paper already referred to, Halliday focuses on the relatively greater abstractness of writing, with the concomitant demand this makes on learners to "reinterpret their experience in the new mode of written language" (in press, p.18). Interestingly, in Thinking and Speech, Vygotsky (1987) gives a very similar explanation of the intellectual development that is fostered by learning to read and write: "Written speech forces the child to act more intellectually ... It is a more difficult and more complex form of intentional and conscious speech activity" (p.204).

As both these scholars point out, written language is more abstract than speech in three ways: first, it involves a 'second-order symbolism', with written symbols standing for the spoken 'words' of speech, which are themselves symbols; second, because the interlocutor is not physically present, the way in which meaning is communicated in writing is more abstract than in speech, since the message has to be realized through the lexicogrammar alone, unsupported by gesture and intonation, and without the opportunity to check understanding and supply additional information on request.

However, it is the third - the abstract nature of the meanings themselves - that is what often makes the written mode more difficult for children than speech. It is for this reason that Halliday describes the development of literacy as involving both the reorganization of the learner's grammar to handle the more abstract categories of written language and also the mastering of a new form of knowledge: "written, educational knowledge as against the spoken knowledge of common sense" (op. cit. p.18).

2. The functions of written text

In order to understand why the meanings expressed in written language are frequently more abstract than those in speech we need to consider the different functions writing is used to perform. Although a written text can be read aloud and speech can be written down, the two modes are not interchangeable, nor are they typically used for the same purposes. In fact, the relationship between them is one of complementarity rather than of correspondence. To a large extent, this is because of the different media that they employ, and the manner in which each is produced and received. Most importantly, compared with speech, written texts have much greater permanence; they are also much slower to produce, and, in reception, much more under the control of the receiver. For all these reasons, extended written texts are particularly suited to activities involving individual reflection whereas, in many ways, the dialogic exchange of meaning characteristic of speech is more suited to collaborative

action.

It is the relative permanence of written text that explains its earliest uses some 3000 years ago. For, from the evidence that is available, amongst the first functions that writing was developed to serve was that of aide-memoire with respect to important practical information to do with trade and taxes (Ong, 1982). And, in a myriad forms, written text still performs this function in almost every sphere of contemporary life (Heap, 1989). Then, from this beginning, we can trace the emergence of two further functions: the archival and the instructional. If records are kept, they can be gathered together and collated, giving rise to bodies of information that can be consulted on future occasions (Olson, in press). Similarly, procedural skills required in the performance of practical activities can be described in written texts so that the passing on of craft knowledge and other similar information is not dependent on transmission by example or word of mouth.

As can be seen, all these functions are very clearly tied to action. In a very obvious sense, the written text serves in each case as a tool, making information available when it is needed in the course of some kind of practical activity. It therefore follows that, to be competent in performing the activity, one needs to know when and how to use the tools of written text, as well as the other tools that play a part in the activity.

However, the uses of written text are not confined to what Heap (1989) refers to as the 'enabling' of practical activity. In every culture that has made widespread use of writing for practical purposes, two further, reflective, functions have eventually emerged. The first of these I have called the 're-creational', intending thereby to capture the dual function of literature as both the recreation in words of the experiences of humankind, both real and imaginary, and also the recreation of the writer or reader through engagement with such texts. Finally, there is what I have called the 'epistemic' function - the use of a text as a tool for thinking and developing new understanding, through the dialogue that takes place between the reader or writer and the text, as he or she struggles to construct meaning that is clear and coherent and, at the same time, consistent with all the available evidence, both in the text and in his or her experience (Wells, 1990).

However, in distinguishing the different functions served by written texts, I do not wish to suggest that texts are strictly monofunctional. In principle, any of the above functions can be served by any text. Nevertheless, there is in practice - as with material tools, such as hammers or saws - a strong correspondence between text-types, or written genres, and the uses to which they are put. And these uses, in turn, are defined by the activities in which they occur.

To return to the apprenticeship metaphor, then, it is clear that induction into the different disciplines involves learning to use the written genres, both practical and reflective, which mediate the activities that constitute those disciplines. And, as the metaphor implies, this learning must take place, not as an independent, decontextualized event, but as an integral part of carrying out those activities.

3. Dynamic and Synoptic Representations

So far, in contrasting written with spoken discourse, I have emphasized the relative

abstractness of the former. I have also drawn attention to the functions that are particularly well served by the permanence which is a defining characteristic of written texts, in particular the 'epistemic' function in which, through a dialogue with the written representation, the writer/reader can use the text as "a thinking device" for generating new meanings and refining those meanings that are already represented (Lotman,1984).

However, there is a third way in which written discourse frequently differs from spoken discourse, particularly in expository genres. And this is in the different ways in which experience is typically constructed in the two modes. Here is how Halliday explains the distinction:

> A written text is itself a static object: it is language to be processed synoptically. Hence it projects a synoptic perspective on to reality: it tells us to view experience like a text, so to speak. In this way writing changed the analogy between language and other domains of experience; it foregrounded the synoptic aspect, reality as object, rather than the dynamic aspect, reality as process, as the spoken language does. This synoptic perspective is then built in to the grammar of the written language, in the form of grammatical metaphor: processes and properties are construed as nouns, instead of as verbs and adjectives. Where the spoken language says whenever an engine fails, because they can move very fast, ... hapens if people smoke more, the written language writes in times of engine failure, relv on their great speed, ... is caused by increased smoking. (Halliday, in press, p.20)

The difference is not simply one of alternative modes of expression, however. As Halliday points out, corresponding to the grammatical differences are different perspectives on experience. In learning to read and write, therefore, children have to "learn to construe their experience in two complementary modes, the dynamic mode of the everyday commonsense grammar and the synoptic mode of the elaborated written grammar" (op.cit. p.21).

However, Halliday is not the only one to have made this kind of distinction. Vygotsky (1987), too, in his account of the development of verbal thought, proposes a similar progression from 'spontaneous' to 'scientific' concepts. Spontaneous concepts, according to Vygotsky, are encountered and learned in the spoken discourse that occurs in the varied and naturally-occurring events of everyday living; the learning of scientific concepts, on the other hand, is dependent on schooling, and in particular on the use of genres of discourse - typically written - in which concepts are systematically related to each other through definition or explanation.

Yet another related distinction is that made by Bruner (1986) between the two modes of thought that he refers to as 'narrative' and 'paradigmatic'. The narrative mode is primary and, as he points out, it underlies children's early experience of conversation. It is a discourse of doings and happenings, of actions and intentions: agents act in the light of prevailing circumstances in order to achieve their goals. This is the dynamic perspective on experience to which Halliday refers and the basis on which Vygotsky's spontaneous concepts are constructed. It is a mode of discourse in which the grammatical organization of the clause corresponds to the 'natural' relationship between the entities, actions and circumstances in terms of which we typically describe and explain behaviour, our own and other people's. In fact, by analogy, even the smallest particles of inanimate matter are endowed with intentions

and potential for action when viewed from this dynamic perspective.

However, the synoptic mode of written discourse - the 'paradigmatic', as Bruner calls it - has its value too. By recoding almost every aspect of experience - processes, attributes and relationships, and even complete events in all their detail - as nouns or nominal structures, it provides a way of symbolically managing the complexity and variability of experience, allowing it to be reconstrued in 'scientific' concepts, which can be systematically related in taxonomies; instances can then be counted, and made amenable to operations of mathematics and logic. Having its origins in the field of science and technology (Halliday, 1988), this powerful discursive tool has, not surprisingly, been appropriated by other fields of inquiry and, in different forms, has come to play a major role in the written genres of exposition and argument in almost all the disciplines. Indeed, as Halliday (in press) observes, "it invades almost every register of adult English that is typically written rather than spoken" (p.21).

At the same time - as is being increasingly recognized - the nominalizing tendency of these 'genres of power' is proving a double-edged sword. While it may facilitate technological discourse, it does so by construing reality in a form that is remote from the dynamic perspective on experience that is embodied in everyday talk. And this makes these genres difficult for students to master. It also creates a division between the technocrats who control them and the uninitiated who do not - a division that, as Halliday points out, "is certainly dysfunctional in a modern democratic society" (1993, p. 32). There are good reasons, therefore, for the attempts that are being made in various domains to modify these written genres to bring them closer to the language of commonsense. However, for the foreseeable future, they are likely to remain the genres of power and, for that reason, students need to be given every assistance in appropriating them so that they can participate fully in the activities in which they are used.

The Complementary Roles of Talk and Text

In the previous section, the emphasis has been on how written text differs from spoken discourse. Now I want to to consider how the differences between the two modes enable them to function in complementary ways in the performance of discipline-based activities.

If we review the contrasts that have already been discussed, together with a number that have only been implied, it can be seen that there is a considerable degree of parallelism between the relevant dimensions. This can be shown by arranging them in tabular form.

Spoken	Written
Action	Reflection
Dynamic	Synoptic
Concrete	Abstract
Spontaneous	Scientific
Narrative	Paradigmatic
Social	Individual
Dialogue	Monologue

Spoken discourse is - relatively speaking - more likely to occur in a social setting, in which

several participants are engaged in dialogue about experience, often involving action - ongoing, or in the immediate past or future - which is viewed from a dynamic perspective. When people engage with written texts, on the other hand, they are more likely to be alone, reflecting on the matter addressed in the text through the medium of a genre which adopts a monologic and synoptic perspective on experience.

Adopting these stereotypical characterizations of the two modes, it is clear that, as tools, talk and text are best suited to mediate different tasks within any activity.[4] Talk is likely to mediate the planning, monitoring and evaluation of the actions to be performed, while published texts may be referred to to supply needed information for these tasks and written notes of various kinds made to record intentions and interim results; then, depending on the nature of the activity, it may conclude with the writing of some form of text that gives an account of what was done and why, and of what was achieved or learned. In this scenario, talk and text are complementary because they perform different functions in mediating tasks that occur at different stages in the activity.

What such a synoptic account fails to capture, however, is the more dynamic manner in which talk and text can complement and enrich each other through an exploitation of the intertextual relationships between them (Lemke, 1993). For it is when participants move back and forth between text and talk, using each mode to contextualize the other, and both modes as tools to make sense of the activity in which they are engaged, that we see the most important form of complementarity between them. And it is here, in this interpenetration of talk, text and action in relation to particular activities, that, I want to suggest, students are best able to undertake what I have called the semiotic apprenticeship into the various ways of knowing.

In the remainder of this section, I should like to explore the significance of such talk about texts from the perspective of two different, although related, kinds of learning that they facilitate. The first concerns the meanings that are being made - what Halliday calls the reconstruing of experience in the grammar of the genres of written text. In the second, it is the function of the text that is focused on - the part it plays in the larger activity, for it is in this context that issues of generic structure seem likely to be most readily understood. To illustrate the different opportunities for learning that talk about text can provide, I shall use a number of examples from work in science, recorded in one classroom over a period of two years.[5]

Building bridges between ways of knowing

First, let us consider the ways in which talk can help with the more abstract meanings that are found in the texts that students are given to read. For example, with texts that present new information or new ways of organizing relatively familiar information, it is possible to offer glosses - paraphrases, explanations or examples - that build bridges between the dynamic and synoptic perspectives and between the language in which each of these is expressed and the students' own experience. Here is a fairly typical example.

In the course of a unit on electricity, one of the nine-year-old members of the class has shown a persistent interest in electricity in the human body and has asked a number of questions about how, if electricity causes shock, it can also play a necessary part in the proper

functioning of the body. To address this issue for Benjamin and the other children, the teacher reads a short passage from a book she has added to the classroom library and then provides a further gloss on the information in the text.[1]

T: I'm going to read this part, 'Electricity in the Human Body' because I know Benjamin is still not satisfied about it. (reads) "Tiny electric signals, which can be called synapses, <travel> through the heart muscles, triggering and coordinating the heart beat. These signals send "echoes" (T adds: They put 'echoes' in inverted commas) through the body tissues to the skin. Here, they can be detected by metal sensors and displayed as a wavy line called the electro-cardiogram."

Now that is the most positive proof that the human body contains electricity .. Have you seen pictures - movies - where people are harnessed up to- and a person had a heart attack and you see this wavy line (demonstrating) .

Cn: Yeah, yeah (excitedly)

T: Now those wavy lines are showing the electricity going through the human body . that's called the electro-cardiogram. And when a person is dead it goes 'deeeeeee'-

C: Yeah, a straight line

Here, the teacher has enabled the students to bring their own experience, whether first-hand or tv-mediated, to contextualize the less familiar language of the written text.

Earlier in the same lesson, the reverse strategy was used. With a chart showing the different sources of energy displayed on the board, the teacher asked the children to mention the sources of energy with which they were familiar in their homes and local community. Over the course of considerable discussion, their contributions were then built with the teacher's guidance into a more comprehensive and taxonomic account, in which a major distinction was made between renewable and non-renewable sources of energy. This co-constructed account was then used to make sense of the information presented in the text of the wall chart.

However, such discussions do not need to be restricted to occasions when the teacher interacts with the whole class. For example, in practical activities, where the students are working in groups and consulting a text that contains instructions for action, the meaning of the text is often clarified by matching the linguistic expressions with the materials available and with what the students already know about actions that may be performed on them. Similarly, in working with a historical text or a novel that a group is studying,

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[1] In this and the following transcripts, the following conventions apply: . = 1 sec. of pause; <> enclose segments where the transcription is uncertain; * = an inaudible word; CAPS = spoken with emphasis; underlining = segments spoken simultaneously.

discussion in which alternative individual interpretations are critically examined and compared can lead to a collaborative interpretation in the construction of which each participant extends his or her own personal understanding.

So far, I have considered talk about texts that are already written, where the problem is to recontextualize the meaning, often synoptically expressed, in the more familiar language of everyday speech. However, the same sort of facilitation can also occur when writers discuss the texts that they themselves are composing. For example, in negotiating what information to enter into a table showing the results of a practical activity, students are led to consider the structure of the table as a form of representation and, in the light of this, to decide what aspects of what they have done and observed it is appropriate to include.

The following example comes from the next stage of such an activity. Working in groups, students have tested a variety of materials to find out which can be used to complete a simple circuit, thereby making a bulb light up. Back in the whole class setting, the groups have reported their results, which have been written in a table in which a check mark has been entered either in the column for 'bulb lights up' or in that for 'bulb does not light'. Now the teacher asks them to draw some conclusions.

T: Now, just from this chart, what does it tell you?
Is something like paper a good conductor of electricity?

(Several children shake their heads)

So what are the materials that are poor conductors of electricity - that do not conduct electricity - where electricity cannot pass through there to get you a complete circuit?
What sorts of materials are not good conductors of electricity? ...
Can you name them? Marie?

M: Cotton reels

T: So what is it made of? Name the material .. did you observe? What's the cotton reel made of?

A: Plastic

T: Plastic . so plastic's not a good conductor, you see .
What other materials?

E: Um . beer bungs and . wood (almost inaudible)

T: Listen to the question . I want you to make a knowledge transformation, OK? I want you to transform what you did . I asked what MATERIALS are not good conductors . I didn't <ask about the> beer bung

E: Wood

T: Wood, plastic . What else are not good conductors?

P: Paper

T: Now these are NON-CONDUCTORS (writing the word above the column in the table for 'bulb does not light up')
Now can you name for me the CONDUCTORS of electricity - the materials not the objects?

In this example, it is the table, as a genre of written text, that serves to focus the double reconstruing of experience, from the dynamic account of the specific objects tested to the more abstract representation in terms of materials, and then from the everyday categories of materials to the synoptic categories of conductors or non-conductors of electricity. And in this case, the teacher makes the process explicit by talking about the 'knowledge transformation' that the students need to make.

Later in the same unit on electricity, several instances of a somewhat similar process were observed among groups of students who were preparing posters to explain the functioning of various devices they had made, each involving some kind of electric circuit. Knowing that their posters would be on display at the science fair for other children in the school, they first discussed what they had done and why in everyday talk, then they decided how this should be expressed in a form suitable for display next to their working model.

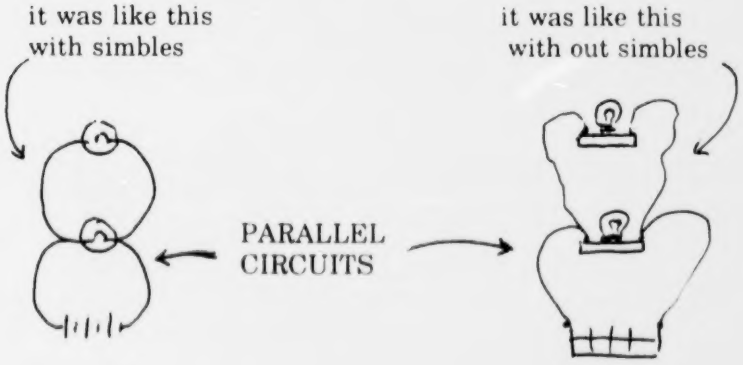
My final example involves a rather different kind of dialogue, but one introduced for the same reason - to encourage the students to use their texts as 'thinking devices' and, in the process, to build bridges between the two modes of representing their experience. From the beginning of the year, the students had been expected to keep a journal in which they wrote about what they had been doing and, more importantly, about what they thought they had learned in the process. In the electricity unit, a further dimension was added: two adults undertook to be journal correspondents, reading what the students had written and writing back with reactions and comments. The hope was that this would give the journal writing a communicative function that it had lacked before. And this indeed turned out to be the case. Many students addressed their entries to the adult partner and, in several cases, designated an area on the page for answers to their questions, including an injunction to the reader to respond.

Because of limitations of space, it is not possible to do justice to the range of genres and styles that were used. Nevertheless, the following example, involving a nine-year-old Chinese-Canadian student, gives an indication of the sort of exchanges that occurred and of the way in which the written journal dialogue helped the students build bridges between the dynamic and synoptic construals of experience.

March 23, 93. Dear Mr. Wells

First today Mrs. Chang gave us an idea of drawing simbles. Then everybody gone to

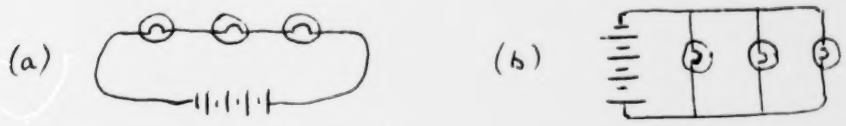
their groups and work on the light bulb. instead it had two bulbs and to make it difficul Mrs. Chang said if we can screw off one bulb off the bulb holder and see if the other bulb still lights up.



Dear Denny,

I liked the way you used symbols in your circuit diagrams.

I have a puzzle for you. Below, I have drawn two circuits. Each circuit uses a 6 volt battery and 2 volt bulbs. If you did this experiment, which bulbs would you predict would be most likely to burn out: (a), (b), both or neither?



I hope you will tell me what you think next time you write. Please explain the answer you give.

Gordon Wells.

Denny's Response:
The bulbs in (b) will be burn out. because the voltage drop on each bulb is 6 volts, but the bulb itself can only take 2 volts.

Making the form fit the function

In the examples of talk about text just considered, I drew attention to the ways in which

collaborative discussion helps participants to clarify and develop their understanding of the 'content' of the texts they are working on and of the synoptic mode in which it is represented. However, as is clear from some of the examples, such discussion can also provide an occasion for learning about the equally important matter of 'form' and, in particular, about the structure of written genres.

As I argued earlier, an apprenticeship into the subject disciplines must include mastering the genres that are used by the members of those discipline-based communities in constructing and applying their 'theories of experience', for these genres are among the essential tools of their crafts.[6] Obviously, it takes many years to develop fluent control of the more specialized genres that are used in the publications of these professional communities, and such a degree of mastery is only achieved over the course of a career in which these genres are regularly used. However, as the notion of specialization suggests, there is a much smaller set of 'basic' genres, from which the more specific varieties are derived, and it is with these that the apprenticeship will naturally begin.

Considerable work has already been carried out in identifying key genres that provide an entry to the discourses of those disciplines that underpin the school curriculum (Martin, 1993) and materials have been developed as a basis for systematic instruction in their use (Derewianka, 1991; Martin et al.,). In this work, genre is defined as "a staged, goal-oriented social process" (Martin et al., 1987) and written genres are seen as particular instances of this more general category. In other words, written genres constitute the culturally developed ways of carrying out certain rather general communicative actions to achieve particular types of goals or purposes in the context of the relevant overarching activities. Thus, in terms of the sociocultural framework presented earlier, the different genres, such as 'recount', 'report', 'explanation', 'exposition' and so on, are best thought of as semiotic tools, whose use - as with other tools - is best learned when they are used to mediate the performance of the activity in question.

From this point of view, it may well be that materials that provide for systematic instruction in the use of particular genres can have a part to play in helping learners to understand the functional significance of their organization, particularly when the learning of the generic structure is embedded in a meaningful activity (Derewianka, 1991). However, it is important to recognize that there are many other occasions on which such learning can occur in the course of the various activities that make up a curriculum unit. Indeed, in all the cases considered above where, in the course of carrying out an activity, the shared reading or writing of a text involved the co-construction of meaning, there was equally an occasion for discussion of the generic structure, as it related to the meanings made with the text and the purpose that the text served in the activity.

Here, there is space to include only one example, which occurred in the previous year in the same classroom as the previous examples. Jessica and Alan (both Chinese-Canadian children) had been conducting an experiment to verify that, as the text that they were using informed them, light is refracted when it passes through water. Pressed by a visitor to explain how their observations provided evidence of light bending, they had in fact gone beyond the experiment suggested in the book and devised a method of convincing both themselves and the visitor that the light beams, projected through two slits in the side of a shoebox containing a jamjar, only crossed when the jar was full of water. As Jessica

triumphantly concluded at the end of the additional experiment, it was the water, not the glass, that made the light bend.

Later, the two children discussed the report they were expected to write with the visitor who had engaged in the experimental activity with them. First they considered who would read the report: people who already knew about refraction or those who didn't. Since their report was to be displayed in the classroom, they eventually decided that they would write for others who might be interested in carrying out the experiment. For this reason, they decided that they should start by 'writing the question'; then they should include two 'steps', one listing the materials needed and the other explaining what they did. There was considerable discussion about the ordering of these steps but Alan was finally persuaded by Jessica's argument:

> cos if you don't tell them the materials they sort of say if they want it- if THEY want to try it out um but don't know what the materials [are] they just- they sort of can't do it.

The remaining steps, it was agreed, would include what they observed and what they learned.

As these two nine-year-olds worked on their reports later in the day,
there was further discussion between them about the actual layout of their report, as well as about the 'steps' they needed to include. Below, I have reproduced - as accurately as possible in the medium of print - the finished version of Jessica's report. What cannot be reproduced, unfortunately, is the series of annotated illustrations of the various stages of the experiment as it was actually carried out.

Bending light.

Question: Can light bend?

1 Materials: One cardbord box, a glass jar filled with water (to make exprimint more clearly put food coloring in water,) sheet of white paper that can fit inside the cardbord box, scissors, ruler, pen and a very bright flashlight.

2 What we did: First we drawed two nawrow slots two cm. apart each other on one side of the cardbord box. Then we cut the slots, put the sheet inside the cardbord box make sure it fits just right. Then we put the glass of water inside the cardbord box, make sure the jar of water is right beside the slots. In a very, very, very dark room (place), shine the flashlight through the two slots.

3 Observations: You might find out that you can only see two slots on the other side of the cardbord box but it doesn't mean that you did it wrong, if you don't belive me, try taking the flashlight and tip the back of it up (slightly) and then tip it so that it is leveled again. Repet that again and again and you will see it cross together, if you don't see it that means your either tiping it to much or you did something wrong. Now, say if you wearn't prety sure if it's crossing together and you want to be realy sure that it's crossed, try this, use one hand

to hold the flashlight and one of your finger to cover one of the slots and then lift your finger up, now look at the other side of the cardbord box where the light will apear and do it again (lift your finger up and down) and if you would notice that when you cover the right slot the left slot will disappar and when you cover the left slot the right slot dissappars, you might wonder why, Because when you cover the right slot the right slot should dissappar, not the left, so this shows you that you may not see it cross but it mabe is.

4 Other questions people ask: Mr. X [Teacher B] asked Alan (my partner) and me a question, "What do you think is causing the light bend?" I said it was the water but my partner said it was the glass so insded we did another exprimint what we did was take out the jar of water and put in another jar but this time without water. we did exacly the same thing, and we tested it with our finger again, but it didn't crossover together. So we new it was the water.

5 Coments: I must say I have to thank [my teacher] for giving me an apertunaty to do this exprimint and learning so much things and also I have to thank [Teacher B] for helping us do this exprimint, thank you both of you. Another coment from myself, the exprimint was neat.

(Jessica)

Some might argue that, because Jessica's text is still an idiosyncratic mixture of several genres, it shows the need for a much more directive form of teaching. However, I would disagree. What is important, in my view, is not whether the texts that are the outcome of such collaborative discussion conform to some abstract prescription of 'report' or 'explanation' - a result that could be produced by filling in spaces in a pro-forma document - but that they have the form they do because the writers have made conscious decisions to construct them in that way in order to achieve the purposes that they set for themselves. Only when this is the case, I would argue, is it possible for them to use reader feedback as a basis for further discussion about whether the text is successful and, if it is not entirely so, about what sorts of changes could be made to improve it. Although this route to mastery may be slower, the advantage is that, at each stage, the learner is in control of the tool and can develop and adapt it to meet her expanding goals as a writer.

Talk, text and activity

With the preceding examples, I have tried to give an idea of some of the different ways in which talk about texts provides the occasion for simultaneously learning the new mode of written language and also the "written, educational knowledge" which is encoded in written texts. In concluding this section, I should like to review the points I have made from the perspective of the apprenticeship metaphor that I introduced earlier.

In sociocultural theory, as I explained above, learning is seen very generally in terms of appropriation. That is to say, learning is the taking over and internalizing of cultural artifacts and practices in the course of engaging in joint activities, in which the functional significance of these artifacts and practices is modelled and the learner receives assistance

in their use. Talk almost always plays a part in this process, as participants discuss what they are doing and why. In the case of the appropriation of symbolic artifacts and practices, however, talk is absolutely essential (Wells, 1990), since the way in which texts perform their mediating function is not as evident as in the case of the artifacts and practices that are used in such traditional, material activities as weaving (Rogoff, 1990) or tailoring (Lave and Wenger, 1991). This is now well understood in the field of emergent literacy, where the widespread occurrence of collaborative talk about books and other texts in the preschool years has been well documented, as have been the benefits to be gained from these practices by young literacy apprentices (Crain-Thoreson, 1993; Heath, 1983; Teale and Sulzby, 1986; Wells, 1986). In the early school years, similar practices are found in the Reading Recovery programme developed by Clay (Clay and Cazden, 1990) and in the 'instructional conversations' that are at the heart of the programs for minority students pioneered by Tharp and Gallimore (1988).

What needs to be emphasized, though, is that it is not only in the early years that learners benefit from working together to make sense of the texts they are reading and writing. The teacher members of my graduate classes have also found that they understand the readings better if they have the opportunity to discuss them in small groups (Wells, 1994b). And the same is undoubtedly true for young adolescents in school, as they grapple with the unfamiliar forms and meanings of the synoptic genres of the subject disciplines in which they are expected to reconstrue their experience. However, as I hope to show below, it is possible to organize almost any curriculum unit in such a way that it provides multiple opportunities for the joint activities in which this sort of collaborative learning can occur.

Before leaving the topic of the complementary relationship between talk and text, however, there is one further point that needs to be made. And that is that, despite the characterisitic differences between these two modes of discourse in both form and function, there are also many intermediate forms that combine some of the features of each. Perhaps most important, in the present context, is the extended turn in dialogue, in which the speaker develops a topic in a systematic way, whether in narrating an event, describing a situation or process, or in stating and justifying a point of view. The oral expositions of new material that figure in many lessons - and which for many teachers are the prototypical form of teaching behaviour - are particularly clear examples of such intermediate modes. Their value is that they provide models of 'talking science' (Lemke, 1990) - or mathematics (Forman, in press) or literature (Chambers, 1993) - which introduce many of the features of the more formal written genres employed in these subjects, but in contexts in which the formal language is interspersed with the "everyday language of common sense".

Such models are undoubtedly important. But, as the main form of assistance, they are certainly not sufficient. Craft apprentices do not develop the skills they need simply by observing the artifacts produced by master craftsmen or even from watching the craftsmen at work. Certainly, the role of the master includes that of modelling the activity and explaining the principles and practices involved. But these contributions are of greatest value, not in the form of abstract precepts, but when offered as guidance and assistance as the apprentice is actually engaged in performing the activity (Collins et al., 1989). Similarly, in order to develop and hone their skills, semiotic apprentices also need guidance and assistance. But for them, too, this help is of greatest value when it is offered while they are at work on challenging projects that make constant demands on them to master the use of

further tools and practices and even to invent new ones of their own.

It is important, therefore, that extended turns should not be the sole prerogative of the teacher. Indeed, as Lemke (1990) emphasizes, if students are to learn the genres in which scientists talk and write about the phenomena of interest to them, they need opportunities to do more than listen to teacher expositions or read what the text-book writers have written. They also need opportunities to talk and write science themselves, to others who are interested in, and responsive to, their contributions.

The same is equally true of other subjects, as is argued by Lampert about teaching mathematics to ten and eleven-year-olds:

> This means we do not proceed as if whatever the teacher says, or whatever is in the book, is what is assumed to be true. It also means that lessons must be structured to pursue the mathematical questions that have meaning for students in the context of the problems they are trying to solve. And this means that lessons are more like messy conversations than like synoptic presentations of conclusions. (1992, p.307)

In fact, "messy conversations" seems a very good way of describing those instances of talk about texts which, because directly related to problems with which students are grappling, are most productive for learning how both talk and text are used to make meaning and develop understanding. And when these conversations occur in the context of activities which the students have made their own, we have come close to optimizing, in school, the conditions under which these tools can be mastered. In the final section of this paper, therefore, I want to consider one way in which these conditions might be created.

Inquiry and Education

In my own learning as a teacher, one of the ways in which sociocultural theory has most helped me is in offering a way of reconciling the opposition that is often perceived to exist between the two overriding goals of education. These are, on the one hand, to ensure that the young are socialized into the values, knowledge and practices of the culture so that they grow up to be responsible and productive citizens and, on the other, to nurture the originality and creativity of individual students so that each is enabled to fulfill his or her unique potential.
As teachers, we often find that, whilst believing in the second goal, the pressure to fulfil the first is so overwhelming that, in practice, there is little time or opportunity left to attend to the second. It is in this professional impasse that I have found the sociocultural metaphor of apprenticeship to be particularly helpful.

Two features of this metaphor, in particular, are worth exploring further. The first is the object of an apprenticeship. Certainly, it includes the passing on of the knowledge and skills of the craft, with an emphasis on application. This is the outcome that is emphasized in much of the current debate about accountability: What is learned in school should enable students to function effectively in the social and economic world beyond; theoretical knowledge is of value to the extent that it has implications for action. And there is much to

be said for the argument that knowledge should be for effective action rather than simply for show under examination conditions.

However, there is more to apprenticeship than reproducing the achievements of the past. For the ultimate object is that the apprentice should become an independent master craftsman, who creates new artifacts and adds to the cultural resources. In fact, all of the inventions that we now take for granted grew out of past experimentation with the resources then currently available, as they were put to novel uses or adapted to deal with new problems in need of solution. In other words, creativity and originality are as much the object of education as is the reproduction of the existing order. Indeed, in the light of the problems facing humankind, they may be of even greater importance.

The second feature that needs to be explored is the means by which these twin objects are achieved. And here, unfortunately, the actual practices of trade guilds in the past leave much to be desired for, by all accounts, the young apprentice's life was very often one of drudgery and exploitation. These are not necessary conditions, however, and were probably as counter-productive in the past as they would be in any school or classroom today. On the other hand, the emphasis on learning through engaging in purposeful activity is as valid today as it ever was. And so is the principle of teaching by proposing challenging goals to be achieved, and providing assistance in meeting them in a form that is appropriate to the learner's needs and with the intention of enabling him or her to appropriate the practices that are enacted jointly, along with the responsibility for learning to manage them on his or her own.

This understanding of the teacher's role in assisting learning was expressed by Vygotsky (1978), somewhat aphoristically, as "what a child can do with assistance today she will be able to do by herself tomorrow" (p.87). The passage occurs in the exposition of his conceptualization of teaching-and-learning as working with the learner in her 'zone of proximal development', that is to say, in the zone between what she can do alone and the upper limit of what she can do with appropriate help. What this means, in practice, is: engaging with learners in activities to which they are committed, observing what they can already do unaided; then providing assistance and guidance that helps them to identify the nature of their problems and to find solutions that enable them to bring the activity to a satisfactory completion. It is in this guiding role that the teacher can most effectively pass on the artifacts and skills developed in the past, for it is under these conditions that their utility is most evident and their mode of functioning most readily understood and mastered.

One way of organizing the curriculum to make this possible is by working with broad, open-ended thematic units, within which individuals or - even better - groups of students choose and plan their own topics of inquiry in consultation with the teacher. By selecting themes that both meet the requirements of the mandated curriculum and match the known or anticipated interests of the majority of the students, and by then sharing with them the responsibility for deciding on specific topics and how they should be investigated, the teacher maximizes the chances of achieving the first requirement - that the students should be engaged in challenging activities that they find personally significant. Under these conditions, student motivation is high and so is their ability to work independently, without the need for constant supervision and control. As a result, this mode of organization also meets the second requirement - that of allowing the teacher to be freed to spend time with individuals or groups, observing their progress and providing appropriate assistance when

it is needed.

The first two requirements are concerned with ensuring that students' learning, and the provision of assistance, are embedded in a broader context of purposeful joint activity which, itself, involves a variety of constituent activities. However, there are two further, equally important requirements. The first is that, as well as being personally significant, the activities in which students engage should, over the unit as a whole, provide opportunities for them to make systematic progress towards mastery of the tools and practices of the discipline. This requirement can be met through the introduction of teacher-selected activities for the whole class, which are interspersed with the students' self-selected activities, and through the specification of genres to be included in students' presentations of their research. It can also be linked with the final requirement, which is that learning through action should be complemented by regular opportunities for learning through reflection. Whether undertaken individually or by the class as a whole, this will need to address both what has been achieved and discovered and the new questions that have arisen as a result, and also the means - the artifacts and practices - that have been employed in the process, as well as the problems encountered, whether solved or still in search of a solution. Whole class reflective discussion is particularly important here for, as well as fostering the development of the collaborative ethos of a community of inquiry, such discussion provides the setting, par excellence, in which knowledge is co-constructed, as students and teacher together make meaning on the basis of each other's experiences, supplemented by information from other sources beyond the classroom.

The overall structure of this inquiry-oriented approach to curriculum can be represented schematically as in figure 1. I must emphasize, however, that this is a 'tool' to be used for thinking and planning, not a prescription to be followed on every - or even any - particular occasion. Such decisions will always need to be made in the light of the curricular topic, the availability of resources of different kinds and, most importantly, the interests and capabilities of the particular class of students. (For further discussion of the model and its various components, see Appendix 1 and Wells (in press a).)[7]

[Insert Figure 1 about here]

In the unit on electricity from which the earlier examples were taken, the Launch took the form of a brainstorming session in which each child first wrote down what he or she knew about electricity and their ideas were then discussed in a whole class session and written on a single large display, together with a list of questions to which students wanted to find answers (Scardamalia and Bereiter, in press). Then, following the viewing of a video-taped programme which provided an age-appropriate introduction to the topic of electricity, the teacher introduced the idea of a science fair, for which groups would construct working models that involved some application of electrical circuits. The models that groups elected to make included a robot with flashing eyes, a truck-mounted electro-magnet and two morse code signalling stations connected by a length of wire.

While work proceeded on these artifacts, the teacher presented a series of challenges of increasing difficulty, starting with designing a simple circuit and continuing through parallel circuits with each bulb controlled by its own switch, to an experiment to discover the variables that determined the strength of an electro-magnet. Each of these activities was

followed by a review session, in which the whole class Interpreted the results of the Research they had just done and Reflected on what they had learned, both about the principles of electricity and about strategies, social as well as practical and intellectual, for successfully solving problems of the kinds encountered. There were also whole class discussions, such as the one quoted from above (p.11), in which questions raised by the children were considered in relation to what was learned from the practical work as well as from consulting reference material of various kinds.[8]

By the end of the unit, then, the children had worked to find solutions to the problems encountered in constructing their chosen models and, through the teacher-posed challenges, had systematically learned about some of the basic principles of electrical circuits, conductivity and electro-magnetism. All this work culminated in a very successful science fair (Presentation), in which the groups' working models were complemented by displays of various kinds which, in every case, included posters providing explanations of the principles involved, as well as other information which group members thought would be of interest to the children from other classes who came to visit their fair.

As will be apparent, such an inquiry-oriented approach to curriculum creates opportunities for students to engage in many modes of discourse, both spoken and written. Earlier, I referred to several that I observed in the course of the curricular unit on electricity that I have just described. In table 1, I have also drawn on my observations of thematic units based in different areas of the curriculum to present a more comprehensive account of the range of genres that might play a part as tools in mediating students' inquiries.

In presenting this summary, I have generalized across different patterns of participation. For example, in suggesting the genres of spoken discourse that might occur, I have not indicated the size of group that might be involved, as this might vary from a couple of students working together to the whole class. In the case of presentations, on the other hand, the audience might involve another class or parents and other adults invited for the occasion. Similarly, with respect to written texts: these might be produced by individual students or by collaborating groups and, where appropriate, addressed to a wider audience than the teacher alone through the use of class bulletin boards, or a class or school newspaper. In several cases that I have known, the final products of groups' inquiries, usually involving a variety of genres, were 'published' in book form and added to the resources in the school library. Finally, although I have only included 'journal entries' once, students might be encouraged to make regular entries in their journals or learning logs at all stages in their inquiries.

[Insert Table 1 about here]

Looked at from the perspective of semiotic apprenticeship, table 1 lists some of the more important discursive tools and practices that are utilized in carrying out an inquiry and indicates the tasks for which they are particularly useful. No doubt there are others that could or should be included, depending on the nature of the inquiry.

Whether spoken or written, however, the genres included in this table emphasize the interpersonal functions of discourse. Together, they make up a tool-kit for coordinating action and for negotiating and communicating participants' understanding with respect to their joint

activities. However, they can also be seen as providing a similar resource for the intra-personal actions that participants carry on when they are alone, in what Vygotsky (1987) called the discourse of inner speech. From this perspective, participation in the genres of social discourse not only provides the means for the co-construction of knowledge; it also enables learners to appropriate the practices and artifacts and to use them to mediate the solo mental actions of thinking, imagining and reasoning. It goes without saying, of course, that these two broad functions - the inter-personal and the intra-personal - are interdependent and complementary, since they both mediate activities which, because they involve meaning, are inherently social and cultural.
They are thus perhaps best seen as different phases of the continuing apprenticeship. As new genres of discourse are encountered and progressively mastered in inter-personal activity, they extend and transform the individual's intra-personal activity, and this, in turn, enables him or her to participate more fully and effectively in further inter-personal activity, in a never-ending spiral.[9]

Conclusion

In this paper, I have outlined a conception of education in terms of semiotic apprenticeship - an opportunity, through guided participation in discipline-based forms of inquiry, to appropriate the cultural tools and practices for meaning-making in the construction and application of knowledge in all areas of human activity. In this enterprise I have accorded a special place to language, seeing in the various genres of spoken and written discourse a kit of tools that performs a dual function, both mediating participation in activity and simultaneously providing a medium in which activity is represented and thus made able to be reflected upon.

In this conception - as befits the central metaphor - the emphasis is on the learner and on the conditions that enable him or her to master the means for full participation in the activity of inquiry, both alone and in collaboration with others. As a consequence, it may appear that my intention has also been to deemphasize the importance of teaching. This is certainly not the case. However, an acceptance of this view of the classroom as a community of inquiry, in which learners share with the teacher the responsibility for deciding on the topics and on the means for their investigation, may indeed call for a reexamination of the ways in which the teacher's role might best be enacted (Wells, 1994b).

However, in suggesting that we need to reexamine our conception of teaching, I am not arguing for the supplanting of one set of practices by a different set, that is already fully worked out and waiting to be applied. On the contrary: Every school and every classroom presents its own set of opportunities and constraints, and there is no set of practices that is guaranteed of universal success. Models, such as the one that I presented above, are no more than tools to be adapted in use to fit the prevailing conditions; it is to be expected, therefore, that they will be transformed by those who use them. The version represented in the examples quoted in this paper was developed by Gen Ling Chang to meet the needs of a culturally and socioeconomically diverse class of nine and ten-year-olds in Toronto. In other places, or with other grade levels, a different version might be more appropriate.

In other words, what I am suggesting is that teaching, like learning, is an ongoing process

of inquiry, in which the knowledge that is constructed about learners and learning, as these are encountered in particular situations, continuously transforms the teacher's way of understanding and acting in the classroom. However, the practices of inquiry are not learned in isolation, nor do the various genres of discourse that mediate those practices take on their full value outside a context of joint activity. Like students in the classroom, therefore, teachers need to be participants in communities of colleagues who use the tools of inquiry to learn the craft of teaching (Wells, 1994a). Furthermore, it is when we are ourselves intentional learners and inquirers that we most effectively model the practices that we wish our students to learn. For if what we learn is what we do - to rephrase Dewey's maxim - then what we do depends on the practices that are avilable for us to appropriate from the communities in which we participate.

1. The preparation of this paper was supported, in part, by a grant from the Spencer Foundation to the Ontario Institute for Studies in Education for a project entitled 'Learning through Talk'; however, the views expressed are those of the author and not necessarily those of the Foundation. I should like to thank the members of the Grade 4 and 5 class whose talk and texts are quoted in this paper both for allowing me to work with them and for what I learned from our collaboration. I should particularly like to thank the teacher, Gen Ling Chang-Wells, for the many discussions we had about her reasons for organizing the unit in the way she did and for her insightful comments on my interpretations of what I observed. Finally, I must acknowledge my debt to Glenn Humphreys and Patrick Allen for their constructive criticisms and comments on an earlier draft of this paper.

2. This triple transformation, as it applies in the appropriation and use of language as tool for both social and individual activity, is further discussed in Wells (in press b). As Halliday (1978) points out, each instance of language in use transforms the situation in which it occurs and either confirms or modifies the participants' view of the world, as this is construed in terms of the cultural categories encoded in language; by the same token, the language code is itself gradually transformed over time by the novel uses that spekers and writers make of it (Halliday, 1993).

3. In systemic linguistics, variation according to the use that is being made of language is handled in two related ways. Register accounts for the relationship between the social situation and the linguistic choices that are, so to speak, 'at risk' in it. Characterizing the situation in terms of three categories of properties - field, what is going on; tenor, the roles and statuses of the participants; and mode, the part that language is playing in the situation - Halliday defines register as "the range of meaning potential that is activated by the semiotic properties of the situation" (1975, p.126). Genre, on the other hand, accounts for the sequential organization of the stages by means of which the event is linguistically accomplished. For example, in a service encounter in a shop, there are five obligatory elements or stages - sale request, sale compliance, sale, purchase, and purchase closure - which must occur in that order (Hasan, 1985). The discourse that actually occurs on any particular occasion can thus be accounted for by a combination of these two ways of thinking about variation (see Halliday and Hasan, 1985, for a much more detailed exposition). In applying these two concepts to the context of education, Martin (1993) argues for the practical utility of giving primacy to genre, and this is the approach that I shall adopt here.

4. In Halliday's terms, all purposeful uses of language, whether spoken or written, involve the construction of text - discourse that is "functional in some context of situation" (in press, p.16). This is an important point that should not be forgotten. However, in popular usage, the term 'text' is usually restricted to written discourse, which is distinguishable from spoken discourse in a number of ways, and not least - as I have suggested - by its relative permanence. Since this difference is particularly consequential for my argument, I shall stay with popular usage, referring to the two modes as 'talk' and 'text'.

5. This unit occurred in a Grade 4 and 5 class in an inner-city school in Toronto. Because of its location, the school serves a very diverse community; many of the children come from nearby Chinatown, but some are brought in from suburban homes by parents who work in professional occupations in the adjacent hospitals and offices. The majority of children in this class spoke a language other than English at home and a few, being recent arrivals in Canada, were still in the early stages of learning the language of the classroom. As well as containing a number of children designated 'gifted', the class also included several children who were receiving help in part-time withdrawal programmes for literacy learning and behavioural difficulties.

As this study of electricity took place in March and April, the children had already had some experience of engaging in sustained inquiry, both in science and social studies. From the work on display in the classroom, it was clear that, wherever possible, connections were made between the topics chosen for inquiry and the children's activities in mathematics, literature, art and drama. The study of electricity should be seen, therefore as one theme within a curriculum that was both integrated and challenging.

6. While writing this paper, I came across the following paragraph, written by a professional scientist:

> Another problem with this ['scientific method'] paradigm is that it focuses only on the performance of experiments and overlooks that science is a social effort requiring communication. Because advances in science are interdependent, all the arts of communication are essential to science. Scientists visit one another's labs, travel to conferences, speak by telephone, hold advisory committee meetings, teach, argue, and write papers together, often using electronic mail. (Tinker, 1993, p.2)

7. Not all applications of the apprenticeship model of learning provide so much scope for student initiative and creativity. Examples of more narrowly focused approaches are Brown and Palincsar's 'Reciprocal Teaching' (Palincsar and Brown, 1984; Brown and Palincsar, 1989) and Cole and Engestrom's (1993) 'Question-Asking-Reading'. An approach more like the inquiry model presented here is described in Gamberg et al. (1988), with many examples of themes that have proved successful with elementary age children. See also Kierstead (1985) for an overview of a similar approach to curriculum planning.

8. Benjamin, for example, searched among his father's books at home, consulted his uncle, a doctor, and accessed - with his teacher's help - the relevant entries in the CD-ROM Grollier Encyclopedia, in order to find out more about the role played by electricity in the human body.

9. There is one further feature of this table that only struck me after I had completed it: Quite unintentionally, I had for the most part chosen process terms to describe the genres of oral discourse, but product terms to describe the written genres. Whether or not this is appropriate, it does reinforce Halliday's point, quoted above, about the more synoptic, object-like nature of written text as compared to the dynamic, in-process nature of talk.

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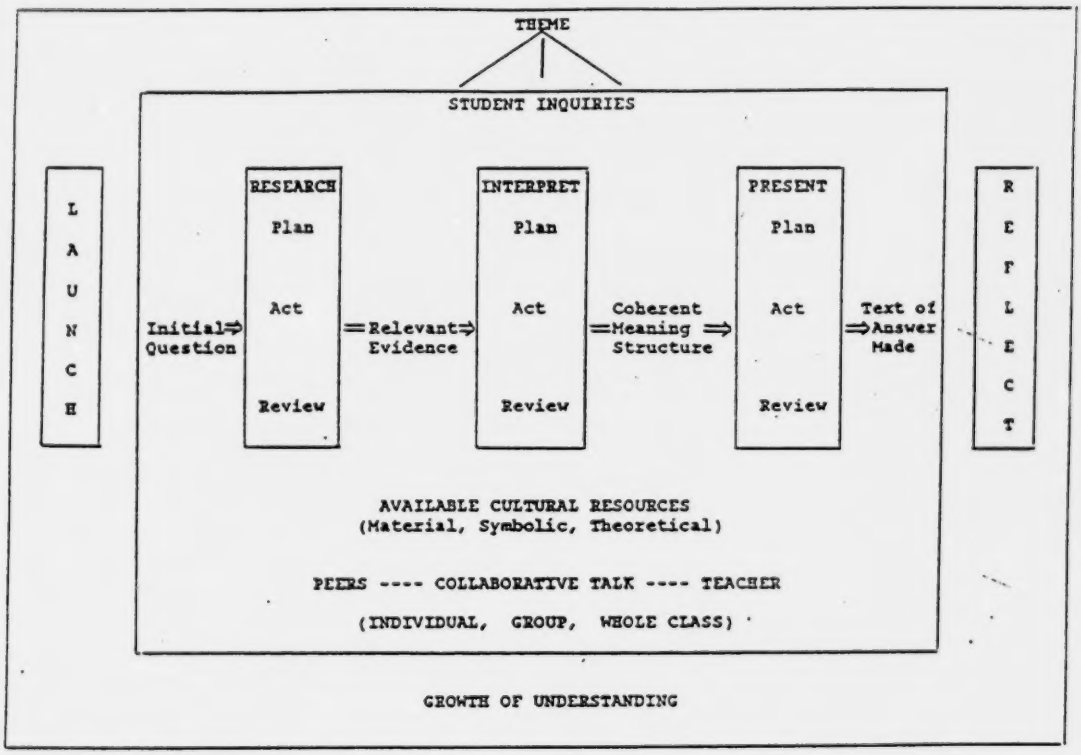
Figure 1 An Interactive Inquiry Model of Learning and Teaching



from Wells in press

Table 1. Genres of Discourse as Tools for Inquiry

	Oral Discourse	Written Discourse
Response to the Launch event:	Drama, exploratory discussion, etc.	Poem, journal entry, etc.
	Brain-storming, formulating questions, hypothesizing, etc.	Statement of inquiry or of initial theory, etc.
Research:	Planning, negotiating, coordinating and monitoring action;	Plan, list, instructions; letters requesting information;
	Observing, interviewing, consulting reference books;	Notes, tables of results, protocols, diagrams;
Interpretation:	Interpreting evidence, debating alternative interpretations, drawing warranted conclusions;	Concept maps or webs, lists of arguments for and against alternative interpretations;
Presentation:	Planning, negotiating, coordinating and monitoring action;	Plan, outline;
	Drama, report, video/audio program, commentary, panel, etc.	Narrative of events, procedural description, illustration, report, explanation;
Review:	Reflecting, theorizing, evaluating;	Summary, reflection, evaluation.